# "Belgian modified classification of Maastricht for donors after circulatory death"

Evrard, Patrick ; Belgian Working Group on DCD National Protocol ; Lois, Fernande ; Darius, Tom ; De Pauw, Luc ; Hantson, Philippe ; Jacquemin, Dominique ; Schamps, Geneviève ; Van Deynse, Dominique ; Rondelet, Benoît ; Verschuren, Franck

**Abstract**

BACKGROUND: "Non-heart-beating donors," or, in a more recent and international definition, "donors after circulatory death," are a potential and additional group of deceased persons who are able to add organs to the pool. METHODS: A new classification is proposed on the basis of the result of a consensus of experts issued from all Belgian transplant centers. RESULTS: The first level of definition is simple and based on whether the situation is uncontrolled (categories I and II) or controlled (categories III, IV, and V). In category I, the patient is declared "dead on arrival" and, in category II, there is an "unsuccessful resuscitation" whether it occurred out or in the hospital for both situations. Category III is the most usual situation in which the treating physician and family are "awaiting cardiac arrest" to declare the death of the patient. Category IV is always characterized by "cardiac arrest during brain death." The special situation of the Belgian law allowing the euthanas...

Document type : *Article de périodique (Journal article)*

# Belgian Modified Classification of Maastricht for Donors After Circulatory Death

P. Evrard*, on behalf of the Belgian Working Group on DCD National Protocol

Intensive Care Unit, CHU Dinant Godinne, UCL Namur, Université Catholique de Louvain, Yvoir, Belgium

## ABSTRACT

Background. "Non-heart-beating donors," or, in a more recent and international definition, "donors after circulatory death," are a potential and additional group of deceased persons who are able to add organs to the pool.

Methods. A new classification is proposed on the basis of the result of a consensus of experts issued from all Belgian transplant centers.

Results. The first level of definition is simple and based on whether the situation is uncontrolled (categories I and II) or controlled (categories III, IV, and V). In category I, the patient is declared "dead on arrival" and, in category II, there is an "unsuccessful resuscitation" whether it occurred out or in the hospital for both situations. Category III is the most usual situation in which the treating physician and family are "awaiting cardiac arrest" to declare the death of the patient. Category IV is always characterized by "cardiac arrest during brain death." The special situation of the Belgian law allowing the euthanasia is elaborated in category V, "euthanasia," and includes patients who grant access to medically assisted circulatory death. Organ donation after euthanasia is allowed under the scope of donation after circulatory death.

Conclusions. This classification conserves the skeleton of the Maastricht one, as it is simple and clear, but classifies easily the different donors after circulatory death types by processes for ethical issues and for the non-medical or non-specialized reader interested in the field. This is also an argument for public consideration and trust in the difficult field of organ donation.

"NON–HEART-BEATING DONORS" (NHBD), or, in a more recent and international definition, "donors after circulatory death" (DCD), are a potential and additional group of deceased persons who are able to add organs to the pool. Harmonization in definition and classification would be very useful.

## METHODS

The Belgian Transplantation Council and the Belgian Transplantation Society organized a working group on DCD, covering its aspects (legal and ethical aspects, concern about procurement and perfusion, surgical technique, warm ischemia time definition, etc). This working group consisted of experts (emergency, anesthesia and intensive care physicians, legal and ethical professionals, transplant coordinators, and transplant surgeons) from all universities and university hospitals and from some non-university hospitals. One part of the task of this working group was to update the definition of the DCD classification.

## RESULTS

DCD describes the procurement of organs for the purposes of transplantation that follows death confirmed by means of circulatory criteria. This differs in respect to the actual model for deceased donation, which is the donation after the confirmation of death through the use of neurological criteria ("heart-beating donation [HBD]" or "donation after brain death" [DBD]). In the beginning of the era of transplantation, most of the donors were DCD, whereas later (and due to better outcome), DBD became the standard. Recent re-interest rose in DCD donors, as a consequence of better preservation techniques and a better insight into different categories of

*Address correspondence to Patrick Evrard, Lung Transplant Medical Director, Intensive Care Unit, CHU Dinant Godinne|UCL Namur, Université Catholique de Louvain, 1, avenue Thérasse, 5530 Yvoir, Belgium. E-mail: patrick.evrard@uclouvain.be

0041-1345/14
http://dx.doi.org/10.1016/j.transproceed.2014.09.169

**Table 1. Maastricht Categories for Donors After Circulatory Death (Kootstra, 1995)**

| | |
|---|---|
| Uncontrolled DCD | |
| I Dead on arrival | Includes victims of a sudden death, whether traumatic or not, occurring out of the hospital and who, for obvious reasons, have not been resuscitated. |
| II Unsuccessful resuscitation | Includes patients who have a CA and in whom CPR has been applied and was unsuccessful. CA occurs within the hospital, being attended by healthcare personnel with immediate initiation of CPR. |
| Controlled DCD | |
| III Awaiting cardiac arrest | Includes patients in whom withdrawal of life-sustaining therapies is applied, as agreed on within the healthcare team and with the relatives or representatives of the patient. |
| IV Cardiac arrest while brain-dead | Includes patients who have a CA in the process of the determination of death by neurologic criteria or after such determination has been performed but before the transfer to the operating theater. It is likely that restoration of cardiac activity is first attempted, with a switch to the protocol of donation after circulatory death, if this fails. |

Abbreviations: CA, cardiac arrest; CPR, cardiopulmonary resuscitation.

DCD donors (the so-called Maastricht classification). In modern literature, more and more data are available that the results after organ (kidney, liver, lung, etc) transplantation through DCD are acceptable or good. Also in Belgium, different organs were transplanted with DCD donors. It is important to realize that DCD is only one of the strategies to expand the donor pool, and each transplant program should focus on expanding all potential donor pools, including living donors' deceased donation after brain death and expanded-criteria donors and not DCD donors alone. Finally, using DCD donors to expand the donor pool has challenged the transplant community on several grounds. The use of DCD donors has challenged the ethical discussion on end-of-life treatment and death. DCD donation also has demonstrated the different legal frameworks between different countries because DCD donation is not accepted in every country. Some countries are not even allowed to accept the transplantation of DCD donor organs that are procured elsewhere.

## Previous Classifications

The NHBD Maastricht classification (Table 1) [1] came up during a workshop held in Maastricht in 1995. This has been used worldwide over the past 15 years. This classification has the advantage of characterizing the DCD processes that may have their own particularities, including ethical or surgical aspects; it also has the advantages of simplicity and usefulness. Up to now, all other attempts to improve the Maastricht classification added new categories that are based on different ischemic graft insults leading to potential different transplant results, despite the fact that the DCD situation was already included in the Maastricht classification.

A Spanish national consensus proposed a "Modified Maastricht classification for DCD" (Madrid 2011), adapted to the reality and experience of its country with categories 1 and 2 (Table 2) [2]. The Eurotransplant organization officially recognized the particular donation after euthanasia in The Netherlands, Belgium and Luxemburg. The modified and more complete categorization proposed by Detry et al [3] better define the different situations encountered in the different groups and countries with active DCD programs (Table 3). The WHO Critical Pathway for deceased donation classified DCD according to the phase of the process as possible, potential, eligible, actual and utilized donors (Fig 1) [4,5]. These last classifications are more complex.

## New Classification

The new classification conserves the skeleton for further improvement, as it is simple, clear, and classifies easily the different DCD types by processes for ethical issues and for the non-medical or non-specialized reader interested in the

**Table 2. Modified Maastricht Classification for Donors After Circulatory Death (Madrid, 2011)**

| | |
|---|---|
| Uncontrolled DCD | |
| I Dead in the out-of-hospital setting | Includes victims of a sudden death, whether traumatic or not, occurring out of the hospital and who, for obvious reasons, have not been resuscitated. |
| II Unsuccessful resuscitation | Includes patients who have a CA and in whom CPR has been applied and was unsuccessful.<br>II.a. Out-of-hospital<br>CA occurs in the out-of-hospital setting and is attended by an extra-hospital emergency service that transfers the patient to the hospital with cardiac compression and ventilatory support.<br>II.b. In-hospital<br>CA occurs within the hospital, being attended by healthcare personnel with immediate initiation of CPR. |
| Controlled DCD | |
| III Awaiting cardiac arrest | Includes patients in whom withdrawal of life-sustaining therapies is applied*, as agreed on within the healthcare team and with the relatives or representatives of the patient. |
| IV Cardiac arrest while brain-dead | Includes patients who have a CA in the process of the determination of death by neurologic criteria or after such determination has been performed but before transfer to the operating theater. It is likely that restoration of cardiac activity is first attempted, with a switch to the protocol of donation after circulatory death, if this fails. |

Abbreviations: CA, cardiac arrest; CPR, cardiopulmonary resuscitation.
*Includes withdrawal of any type of ventricular or circulatory support (ie, ECMO).

**Table 3. Modified Maastricht Classification for Donors After Circulatory Death (Detry, 2012)**

| | |
|---|---|
| Uncontrolled DCD | |
| I Dead in the out-of-hospital setting | 1A. Cardiocirculatory death outside the hospital with no witness. Totally uncontrolled. |
| | 1B. Cardiocirculatory death outside the hospital with witnesses and rapid resuscitation attempt. Uncontrolled. |
| II Unsuccessful resuscitation | 2A. Unexpected cardiocirculatory death in the ICU. Uncontrolled. |
| | 2B. Unexpected cardiocirculatory death in the hospital (ER or ward), with witnesses and rapid resuscitation attempt. Uncontrolled. |
| III Awaiting cardiac arrest | 3A. Expected cardiocirculatory death in the ICU. Controlled. |
| | 3B. Expected cardiocirculatory death in the OR (withdrawal phase >30 min). Controlled. |
| | 3C. Expected cardiocirculatory death in OR (withdrawal phase <30 min). (Highly) controlled. |
| Controlled DCD | |
| IV Cardiac arrest while brain-dead | 4A. Unexpected cardiocirculatory arrest in a brain-dead donor (in the ICU). Uncontrolled. |
| | 4B. Expected cardiocirculatory arrest in a brain-dead donor (in the OR or ICU). (Highly) controlled. |
| V Euthanasia | 5A. Medically assisted cardiocirculatory death in the ICU or ward. Controlled. |
| | 5B. Medically assisted cardiocirculatory death in the OR. Highly controlled. |

Abbreviations: ICU, intensive care unit; ER, emergency room; OR, operating room.

field (Table 4). This is also an argument for public consideration and trust in the difficult field of organ donation.

All the relevant times should be defined and reported separately for ischemia calculation.

### Controlled Versus Uncontrolled

The first level of definition is simple and is based on whether the situation is controlled (categories III, IV, and V) or not controlled (categories I and II). These are usually kept from the old into the new classifications.

### Category I: Dead on Arrival

This category includes victims of a sudden death, whether traumatic or not, occurring out of or in the hospital and who, for obvious reasons, have not been resuscitated. Once the circulatory death is certified by a physician on the scene, the dead body can be transferred into the hospital for organ recovery, depending on country regulation and laws.

### Category II: Unsuccessful Resuscitation

This category includes patients who have a cardiac arrest (CA) and in whom cardiopulmonary resuscitation has been applied and was unsuccessful. CA occurs out of or in the hospital, being attended by healthcare personnel with immediate initiation of cardiopulmonary resuscitation. Circulatory death is only declared after a "no-touch period," which excludes possible auto-resuscitation.

### Category III: Awaiting Cardiac Arrest

This category includes patients in whom withdrawal of life-sustaining therapies is applied, as agreed on within the

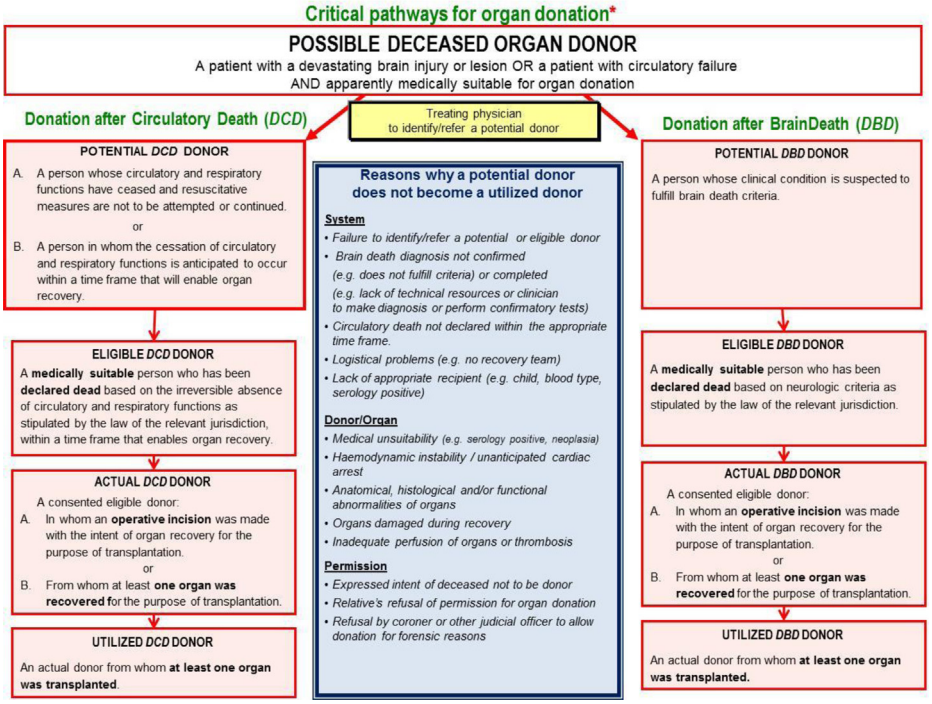


**Fig 1.** World Health Organization critical pathway for deceased donation [4].

**Table 4. Belgian Proposed Classification for Donors After Circulatory Death**

| | |
|---|---|
| Uncontrolled DCD | |
| I Dead on arrival | Includes victims of a sudden death, whether traumatic or not, occurring out of or in the hospital and who, for obvious reasons, have not been resuscitated. |
| II Unsuccessful resuscitation | Includes patients who have a CA and in whom CPR has been applied and was unsuccessful. CA occurs out of or in the hospital, being attended by healthcare personnel with immediate initiation of CPR. |
| Controlled DCD | |
| III Awaiting cardiac arrest | Includes patients in whom withdrawal of life-sustaining therapies is applied, as agreed on within the healthcare team and with the relatives or representatives of the patient. |
| IV Cardiac arrest while brain dead | Includes patients who have a CA during a DBD procedure. |
| V Euthanasia | Includes patients who grant access to medically assisted circulatory death. |

Abbreviations: CA, cardiac arrest; CPR, cardiopulmonary resuscitation; DBD, donation after brain death.

healthcare team and with the relatives or representatives of the patient. DCD procurement is a medically planned, controlled procedure in an intensive care unit patient in whom further medical treatment is deemed futile (Fig 2).

The treating physician is responsible and takes the medical decisions concerning the end of life: consensus about limiting orders such as do not resuscitate, do not start new treatments (withholding), stop useless (ineffective) treatments (withdrawal), or start comfort therapy and/or palliative care. The intention of comfort therapy is to promote the well-being of the patient; some types of comfort therapy can be life-shortening as a non-intended side effect (principle of double effect). Negative side effects (life-shortening) are proportionally acceptable. The highest value is the human dying process for the terminally ill patient.

Once the decision is taken, the transplant team is informed, and procedures for organ donation may begin.

If the patient's death results from stopping of ventilation followed by cardiac arrest, correctly humanly and medically supported, it is in any case a question of euthanasia. Resort to a type III DCD donor remains the consequence of the decision to stop a treatment becoming useless, going against patient's dignity. The distinction of decisional places and decisional times will avoid any intentional causal link between the decision of stopping treatment in the Intensive Care Unit and of stopping ventilation in the operating theater. Cross-information to all intervening people concerning the aims will allow each of them to take on their own ethical responsibilities.

Circulatory death is only declared after a no-touch period, which excludes possible auto-resuscitation.

### Category IV: Cardiac Arrest While Brain Dead

This category includes patients who have a CA after the determination of death by neurological criteria but before aortic cross-clamping in the operating theater has been performed. It is likely that restoration of cardiac activity is first attempted, with a switch to the protocol of donation after circulatory death, if this fails.

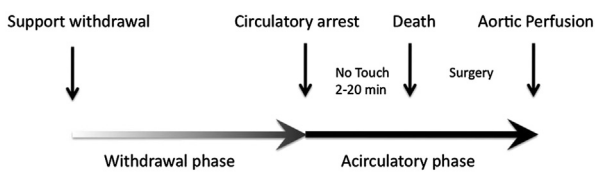


**Fig 2.** Process of controlled donation after circulatory death [3].

### Category V: Euthanasia

This category includes patients who grant access to medically assisted circulatory death. Euthanasia is legally approved in some countries and defined as the "act practiced by a third party who deliberately puts an end to the life of a person, on request of this one." Some individuals who have granted access to euthanasia expressed their willingness to have their organs procured after death. Organ donation after euthanasia is allowed under the scope of donation after circulatory death. Most patients who require euthanasia in Belgium and in The Netherlands are cancer patients who are clearly not candidates for DCD donation. However, a small proportion of these cases are patients with severe, stable neurological deficits, whose medical affectation cannot be transmitted through organ donation. These patients are potential DCD donors. Most euthanasia is performed at home by the regular family physician, but DCD donation after euthanasia requires one to perform the euthanasia in an operating room (or in a preparation room close to the operating room to allow the presence of the family at the time of death).

## CONCLUSIONS

Belgian experts agreed on a new classification that conserves the skeleton of the Maastricht classification, as it is simple and clear, but easily classifies the different DCD types by processes for ethical issues and for the non-medical or non-specialized reader interested in the field. This is also an argument for public consideration and trust in the difficult field of organ donation. Organ donation after euthanasia is introduced as a fifth category according to the Belgian law. Some individuals who have granted access to euthanasia expressed their willingness to have their organs procured after death. Organ donation after euthanasia is allowed under the scope of donation after circulatory death.

## ACKNOWLEDGMENTS

Members of the Belgian DCD Working Group national protocol are Bennie Amerijckx, UZ Brussel; Jacques Berre, ULB Bruxelles; Michael Bos, The Netherlands; Luc Colenbie, Belgian Transplant Council Secretary; Tom Darius, UCL Bruxelles; Luc Depauw, UCL Bruxelles; Bruno Desschans, UZ Leuven (co-chair); Olivier Detry, CHU Liège; Didier Desruelles, UZ Leuven; Marie-Hélène Delbouille, CHU Liège; Annick De Weerdt, UZ Antwerpen; Patrick Evrard, UCL Yvoir (Chair); Patrick Ferdinande, UZ Leuven; Bolle Frédéric, ULB Bruxelles; Ivo Haentjens, UZ Gent; Philippe Hantson, UCL Bruxelles; Eric Hoste, UZ Gent; UZ Gent; Dominique Jacquemin, UCL Louvain-la-Neuve; Jean Joris, CHU Liège; Ilse Kerremans, Ministry of Health Gift Project Representative; Hervé Lebbinck, AZ Veurne; Didier Ledoux, Ministry of Health Gift Project Representative; Fernande Lois, UCL Bruxelles, Diethard Monbaliu; UZ Leuven; Arne Neyrinck, UZ Leuven; Xavier Rogiers, UZ Gent; Benoit Rondelet, ULB Bruxelles; Geneviève Schamps, UCL Louvain-la-Neuve; Paul Schotsmans, UZ Leuven; Joris Troubleyn, UZ Brussels; Dominique Van Deynse, UCL Bruxelles; Walter Van Donink, UZ Antwerpen; Hans Van Vlierberghe, Belgian Transplant Council president; Guy Verfaillie, UZ Brussels; Franck Verschuren, UCL Bruxelles; An Vijverman, Leuven; and Dirk Ysebaert, UZ Antwerpen.

## REFERENCES

[1] Kootstra G, Daemen JHC, Oomen AP. Categories of non-heart-beating donors. Transplant Proc 1995;27:2893–4.

[2] Donation after circulatory death in Spain: Current situation and recommendations. National Consensus Document. 2012. Available at: http://www.ont.es/infesp/Paginas/DocumentosdeConsenso.aspx.

[3] Detry O, Le Dinh H, Noterdaemer T, et al. Categories of donation after cardiocirculatory death. Transplant Proc 2012;44:1189–95.

[4] Third WHO global consultation on organ donation and transplantation: striving to achieve self-sufficiency. WHO, The Transplantation Society and Organización Nacional de Trasplantes. Transplantation 2011;91(Suppl 11):S27–8.

[5] Dominguez-Gil B, Delmonico FL, Shaheen FA, et al. The critical pathway for deceased donation: reportable uniformity in the approach to deceased donation. Transplant Int 2011;24:373–8.